

## Chapter 1. Global Burden of Chronic Disease: *The Epidemiologic Transition*

### TEST BANK

#### True/False Questions

1. Acute diseases cause more deaths than chronic diseases in the world population.
2. Global aging is a consequence of both increasing longevity and decreasing fertility.
3. On average, women live about five years longer than men.
4. The free radical theory of aging states that aging is caused by the accumulation of reactive oxidation species that damage DNA and important cellular organelles such as mitochondria.
5. The *Hayflick Limit* refers to the point at which daughter cells can no longer divide due to the loss of telomeres from the tips of chromosomes during replication.
6. The fertility rate in the USA is approximately 2.0 per woman during childbearing years, which is slightly *above* the global average.
7. The annual mortality rate in sub-Saharan Africa is approximately twofold higher than the rest of the world.

8. The Russian Federation has one of the highest mortality rates in the world, likely due to high rates of chronic smoking and alcohol abuse.
9. Four major chronic disease groups (cardiovascular disease, cancer, COPD, and diabetes) account for 60% of the deaths worldwide.
10. In impoverished nations, chronic diseases cause more deaths than acute diseases.
11. The global smoking prevalence is about 34% in men and 6% in women.
12. The prevalence of obesity (BMI of 30 or more) is highest in Europe and America.
13. Of the 10 million children who die before reaching 5 years of age, 6 million deaths are attributable to malnutrition and starvation.
14. The Disability-Adjusted Life Years (DALY) measures the impact of early death and long-term disability.
15. Chronic diseases are largely *not* preventable.

## Answers to True/False Questions

1. F

2. T

3. T

4. T

5. T

6. F

7. T

8. T

9. T

10. F

11. T

12. T

13. T

14. T

15. F

### Multiple Choice Questions

1. Global relative mortality from chronic diseases is approximately:

- a. 40%.
- b. 50%.
- c. 60%.
- d. 70%.

2. The current world population is approximately:

- a. 5.5 billion.
- b. 6.5 billion.
- c. 7.5 billion.
- d. 8.5 billion.

3. The annual number of deaths is approximately:

- a. 40 million.
- b. 50 million.
- c. 60 million.
- d. 70 million.

4. The leading cause of death worldwide is:

- a. cancer.
- b. cardiovascular disease.
- c. infection.

- d. stroke.
5. The nation with the greatest longevity is:
- a. United States.
  - b. France.
  - c. Sweden.
  - d. Japan.
6. The global fertility replacement rate per woman is slightly above:
- a. 1.0.
  - b. 2.0.
  - c. 3.0.
  - d. 4.0.
7. Which of the following conditions shows a declining prevalence with aging?
- a. Arthritis
  - b. COPD
  - c. Cancer
  - d. Asthma
8. The term for programmed cell death is:
- a. necrosis.
  - b. apoptosis.
  - c. angiogenesis.

- d. carcinogenesis.
9. The point at which a cell can no longer divide due to successive loss of telomeres from the tips of chromosomes during replication is due to what phenomenon?
- a. The Hayflick Limit
  - b. Chromosomal aneuploidy
  - c. DNA damage by reactive oxygen species
  - d. Mitochondrial damage
10. The demographic transition is due to which of the following?
- a. Population aging
  - b. Increasing fertility
  - c. Declining fertility
  - d. a and b are both correct.
  - e. a and c are both correct.
11. The epidemiologic transition refers to:
- a. decreasing rates of chronic disease and increasing rates of acute disease.
  - b. increasing rates of chronic disease and decreasing rates of acute disease.
  - c. increasing rates of chronic and acute diseases.

- d. decreasing rates of chronic and acute diseases.
12. The highest annual death rates worldwide are found in:
- a. the Russian Federation.
  - b. Afghanistan.
  - c. Sub-Saharan Africa.
  - d. India.
13. The relative mortality from chronic diseases (heart disease, cancer, stroke, COPD, diabetes) in high income nations is approximately:
- a. 55%.
  - b. 65%.
  - c. 75%.
  - d. 85%.
14. The relative mortality from acute conditions (infection, violence, perinatal and maternal disease) in low income nations is approximately:
- a. 40%.
  - b. 50%.
  - c. 60%.
  - d. 70%.
15. Currently, approximately how many people die each year from smoking-related diseases such as heart disease, lung cancer, stroke, COPD?

- a. 5 million
- b. 6 million
- c. 7 million
- d. 8 million

### Answers to Multiple Choice Questions

- 1. d
- 2. c
- 3. c
- 4. b
- 5. d
- 6. b
- 7. d
- 8. b
- 9. a
- 10. e
- 11. b
- 12. c
- 13. c
- 14. c

15. b

### Essay Questions

1. Define and discuss the epidemiologic transition.

Answer: In general, all nations of the world are in various stages of “*epidemiologic transition*” defined as the transition from acute infectious, parasitic and nutritional deficiency diseases as the predominant causes of morbidity and mortality to a predominance of noninfectious chronic diseases.

Chronic non-communicable diseases (heart disease, stroke, cancer, COPD, non-infectious digestive disease such as liver cirrhosis, diabetes, neurological disorders such as Alzheimer’s disease, and chronic renal failure) caused approximately 60% (36 million) of all deaths, whereas relatively acute conditions (infectious and parasitic diseases, accidents, violence, perinatal disease (low birth weight and failure to thrive), maternal conditions, congenital anomalies and malnutrition) accounted for the remaining 40% (24 million) of deaths worldwide.

A crude but effective discriminant of the disease profile of a population is its economic status. Poverty with its attendant poor hygiene, malnutrition, inferior education, heavy use of tobacco and alcohol, and lack of access to effective health care is associated with acute diseases that tend to impact younger generations.

Reciprocally, greater prosperity is associated with chronic diseases more likely to impact older individuals through improved public health practices.

2. Discuss the global pattern of longevity (life expectancy).

Answer: In lesser developed nations, particularly those of central Africa where acute infectious and parasitic diseases prevail and greatly reduce the survival of children and young adults, life expectancy is much less, currently only about 50 years. In highly developed nations such as Japan, USA, and European countries, longevity now approaches or surpasses 80 years, and deaths are more likely due to chronic diseases of old age. The Japanese people currently enjoy the greatest longevity, about 82 years. Longevity in the USA currently stands at 78 years, only slightly higher than the average of more developed nations.

Throughout the world, life expectancy (longevity) for women is 5-10 years greater than for men. With some exceptions in nations where high maternal death rates prevail due to lack of prenatal care, women have lower death rates and better survival at every age.

3. Discuss major reasons for the global decline in fertility.

Answer: Over the past half century, the worldwide fertility rate (*the average number of births per woman during the childbearing years*) has been cut in half,

from 5.0 in the 1950s to 2.5 in the 21<sup>st</sup> century. The decline in fertility rates has been sharpest in the most populous nations such as China, India, and Russia. For example, the fertility rate in China, which has the world's largest population (1.34 billion), decreased from more than 6 in 1970 to 1.6 births per woman in 2006, well below the worldwide replacement rate of 2.1.

There are areas of Africa and the Middle East where fertility rates have remained high with populations consisting of predominately children and young adults. In industrialized nations such as Canada, Germany, Great Britain, and Japan, fertility rates are now well below the replacement rate. In the USA, the fertility rate has decreased from 3.5 in the 1960s to 2.0 currently, only slightly below the replacement rate.

Widespread use of effective contraceptives, the accessibility of medical abortion, and the shifting paradigm for women to pursue professional careers rather than start families have combined to delay their having children. As a consequence of these factors, the reproductive window of childbearing years has been pushed back and dramatically reduced in women around the world. Furthermore, certain family planning incentives and policies such as China's "*one child policy*" in 1979 have contributed to the steep decline in fertility in large populations of the world. These factors have all contributed to the global decline in fertility rates, particularly in the industrialized world.

4. What are the two major theories of aging, and how do they differ?

Answer: Aging is a complex and controversial subject. The aging phenomenon appears to be driven by deterioration in cellular health. It is estimated that the human body consists of tens of trillions of cells. This huge population of cells is divisible into subpopulations, each consisting of billions of cells that comprise certain anatomic structures, organs, and tissues. These component cell populations exist in a state of relative homeostasis performing the essential functions of life.

More than half a century ago, Denham Harman developed the *free radical theory* of aging. His theory states that aging is a consequence of accumulating oxidative damage to cells and cellular components over time.

Telomere attrition from the tips of chromosomes during cell division could reach a critical threshold (called the *Hayflick Limit*) and account for most of the decline in functional efficiency of cell populations and increases in vulnerability to chronic diseases that characterize the aging phenomenon. This is the basis of the *Telomere Theory of Aging*; namely, as an ever-increasing percentage of cells reach their *Hayflick Limit* and are unable to reproduce, then defense, maintenance, and repair of the body become increasingly impaired.

5. What impact has the obesity epidemic had on public health globally?

Answer: The phenotype of an obese individual is characterized by an unnatural excess of body fat. This condition is commonly assessed by the Body Mass Index (BMI) also known as the “*Quetelet Index*” calculated as weight in kilograms divided by the square of height in meters ( $\text{kg}/\text{m}^2$ ). In adults, a BMI of 30 or more is defined as obese.

Worldwide, approximately 10% of men and 12% of women are obese in the world population reflecting the global pandemic of over-nutrition and metabolic overload. However, obesity has increased dramatically in the developed nations of the Americas and Europe where over 20% of men and nearly 25% of women are in the obese category.

Obesity with its associated lipid engorgement of the fat cell (adipocyte) population often produces adverse metabolic effects on blood pressure, cholesterol, triglycerides, and insulin resistance. Based on the results of recent epidemiologic investigations of diverse populations, it is evident that as the BMI climbs above 30, there are corresponding risk increases in many chronic diseases including cardiovascular disease, stroke, type 2 diabetes, and cancer.

6. Discuss the impact of tobacco addiction on global public health.

Answer: Two major risk factors, tobacco and obesity, rival one another as perhaps the greatest public health menaces of all time. Worldwide, approximately

42% of men and 10% of women smoke tobacco accounting for approximately 5.4 million deaths annually. Of these, more than 85% are due to lung cancer, cardiovascular disease, stroke, and chronic obstructive pulmonary disease. Male smokers outnumber female smokers by more than fivefold in the populations of Africa, the Middle East, Asia, and the Western Pacific, whereas female smoking rates are trending higher and may eventually approach male rates in the Americas and Europe.

7. Discuss why stratification of nations by income effectively divides cause-specific disease rates into distinct categories of disease.

Answer: A crude but effective discriminant of the disease profile of a population is its economic status. Poverty with its attendant poor hygiene, malnutrition, inferior education, heavy use of tobacco and alcohol, and lack of access to effective health care is associated with acute diseases that tend to impact younger generations. Reciprocally, greater prosperity is associated with chronic diseases more likely to impact older individuals through improved public health practices.

What is painfully obvious is that among the relatively young populations of central and southern Africa (sub-Saharan Africa), the death rates are the highest in the world. Compared to developed nations such as the United States, Canada, Japan, Great Britain, Australia, and many European nations, whose populations have far

more older people, individuals in African nations such as Swaziland, Botswana, Angola, Niger, Chad, Mozambique, and Zimbabwe have 3-4 times higher risk of dying.

8. Discuss the relative mortality of childhood diseases.

Answer: Another devastating menace to the status of public health is the problem of undernutrition, which currently impacts millions of children, particularly in the underdeveloped nations of the world. Many children living in impoverished nations suffer from malnutrition and near starvation and are highly predisposed to infectious and parasitic diseases leading to diarrhea, dehydration, energy depletion, immunosuppression, and death. Such conditions currently exist in epidemic proportion in low income nations, particularly in sub-Saharan Africa.

In sub-Saharan Africa, conditions of hunger and malnutrition cause life-threatening diarrhea in infants and children, killing 5 million every year before they reach the age of 5 years. Parasitic diseases such as malaria are left untreated, killing 1 million more children annually before they reach the age of 15 years.

Infectious diseases such as HIV disease, hepatitis, and tuberculosis ravage the health of children and young adults, killing nearly 3 million young adults each year. Wars and strife due to political unrest kill 100,000 more young adults every year.

9. Discuss the recent increase in mortality among adult men in the Russian Federation of Nations.

Answer: In Russia, overall mortality has increased sharply since the disbanding of the Soviet Union during 1985-1991. Crude death rates for the Russian population during the 1980s were on par with other industrialized nations (about 8 per 1,000) but have since increased reaching a peak of nearly 15 per 1,000 in 2010.

Recent studies have found a link between excessive alcohol consumption and mortality, particularly among men of working age. Results suggest that approximately half of all deaths in men under 50 years of age are attributable to hazardous drinking. Alcohol-related deaths include cirrhosis of the liver, hepatitis, certain malignancies (hepatocellular cancer, pancreatic cancer, and esophageal cancer), cardiovascular disease, accidents, and violence (homicide and suicide).

10. Define Body Mass Index (BMI) and discuss its use in epidemiologic studies.

Answer: While no single biological factor can satisfactorily explain the disparate profiles of disease-specific mortality for different nations, there is one factor that does provide a crude but effective discriminant of all-cause mortality. Perhaps surprisingly, that factor is the Body Mass Index (or Quetelet Index) defined as weight in kilograms divided by (height)<sup>2</sup> in meters,  $BMI = kg\ wt / (m\ ht)^2$ . Its

potential value as a measure of disease versus health is that BMI is a continuous variable that is easily calculated for every individual. The expectation is that low values are associated with nutritional deficiencies and high values with nutritional excesses.

11. Define Disability-Adjusted Life Years (DALY) and discuss the distribution of DALY worldwide.

Answer: The *Disability-Adjusted Life Year (DALY)* is a measure of overall disease burden, expressed as the *number of years lost due to ill-health, disability, or early death*. The measure was originally developed by Christopher Murray and Alan López in order to characterize the overall burden of disease in populations. The DALY rates are now widely used in the field of public health to assess the impact of death and disability in populations. The population DALY for a disease or health condition is calculated as the sum of the *Years of Life Lost (YLL)* due to premature mortality in the population and the *Years Lost due to Disability (YLD)* for incident cases of the specific health condition:

$$DALY = YLL + YLD.$$

In the nations of sub-Saharan Africa, the DALY are more than twofold higher than the rest of the world, largely due to high mortality rates from both acute and

chronic conditions as discussed earlier in this chapter. Higher than average DALYs are also evident in the war-torn nations of Afghanistan and Iraq.

12. Discuss strategies for the primary prevention of chronic diseases.

Answer: Four major groups of chronic diseases, cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes represent the greatest burden to human health. These four disease groups are the world's biggest killers, causing an estimated 36 million deaths each year and approximately 60% of all deaths globally. Fortunately, these diseases are largely preventable. Up to 80% of heart disease, stroke, and type 2 diabetes, and over 30% of cancers can be prevented by eliminating shared risk factors, mainly tobacco addiction, unhealthy diet and obesity, sedentary lifestyle, and the harmful use of alcohol.

Recently, an international program of tobacco control titled the *Tobacco Free Initiative (TFI)* was ratified and implemented through the auspices of the World Health Organization to curb the epidemic of tobacco-related diseases throughout the world.

The *International Obesity Task Force (IOTF)* was established in 1996 to raise awareness and develop approaches to combat the emerging global pandemic of obesity. The IOTF initiative on the prevention and management of obesity has four main goals: (1) to increase the awareness among governments, health care professionals and the community that obesity is a serious medical condition and a

major health problem with substantial economic costs, (2) to provide evidence and guidance for the development of better prevention and management strategies, (3) to secure the commitment of policy makers to action, and (4) to foster the development of national, regional, and international structures that will enable and support the implementation of action on overweight and obesity.